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US005802217A

United States Patent [19]

Suzuki et al.

[11] Patent Number: **5,802,217**[45] Date of Patent: **Sep. 1, 1998**

[54] **IMAGE READING APPARATUS FOR OBTAINING A SHADING CORRECTION FACTOR USING TWO WHITE REFERENCE MEMBERS**

[75] Inventors: Yasumichi Suzuki, Yokohama;
Masanori Yamada, Kawasaki; Eiji Ohta, Fujisawa, all of Japan

[73] Assignee: Canon Kabushiki Kaisha, Tokyo, Japan

[21] Appl. No.: 541,591

[22] Filed: Oct. 10, 1995

Related U.S. Application Data

[63] Continuation of Ser. No. 125,813, Sep. 24, 1993, abandoned.

Foreign Application Priority Data

Sep. 28, 1992 [JP] Japan 4-258207

[51] Int. Cl.⁶ G06K 9/40; H04N 1/40

[52] U.S. Cl. 382/274; 358/461

[58] Field of Search 358/461; 382/274,
382/272, 254

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Primary Examiner—Yon J. Couso

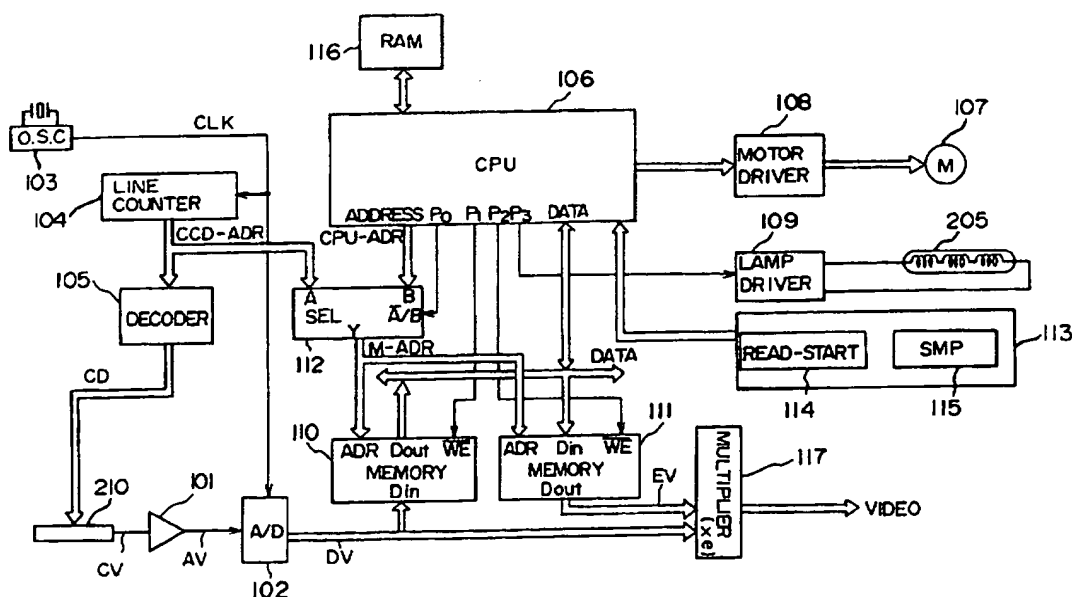
Assistant Examiner—Ha Tran Nguyen

Attorney, Agent, or Firm—Fitzpatrick, Cella, Harper & Scinto

ABSTRACT

An image reading apparatus comprises a reader for photoelectrically reading an image, a first reference member to be used for the measurement of irregularity of an output signal from the reader, a second reference member having density data indicating a density thereof recorded thereon, a correction unit for correcting irregularity of an image signal derived by reading an image of a document sheet by the reader based on a first reference signal derived by reading the first reference member by the reader, and a compensation unit for compensating the irregular correction operation by the correction unit based on a second reference signal derived by reading the second reference member by the reader and the density of the second reference member derived by reading the density data.

9 Claims, 6 Drawing Sheets





US005317421A

United States Patent [19]

Ito

[11] **Patent Number:** **5,317,421**[45] **Date of Patent:** **May 31, 1994**

[54] **WHITE REFERENCE DATA GENERATING UNIT APPLIED TO SHADING CORRECTION SYSTEM**

[75] **Inventor:** Masaaki Ito, Yokohama, Japan

[73] **Assignee:** Ricoh Company, Ltd., Tokyo, Japan

[21] **Appl. No.:** 816,671

[22] **Filed:** Jan. 3, 1992

[30] **Foreign Application Priority Data**

Jan. 8, 1991 [JP] Japan 3-011522

Jan. 8, 1991 [JP] Japan 3-011551

Sep. 30, 1991 [JP] Japan 3-276291

[51] **Int. Cl.⁵** H04N 1/04

[52] **U.S. Cl.** 358/464; 358/461;
358/462

[58] **Field of Search** 358/448, 461, 462, 464,
358/465, 163; 382/52, 53; H04N 1/38, 1/40

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Primary Examiner—Edward L. Coles, Sr.

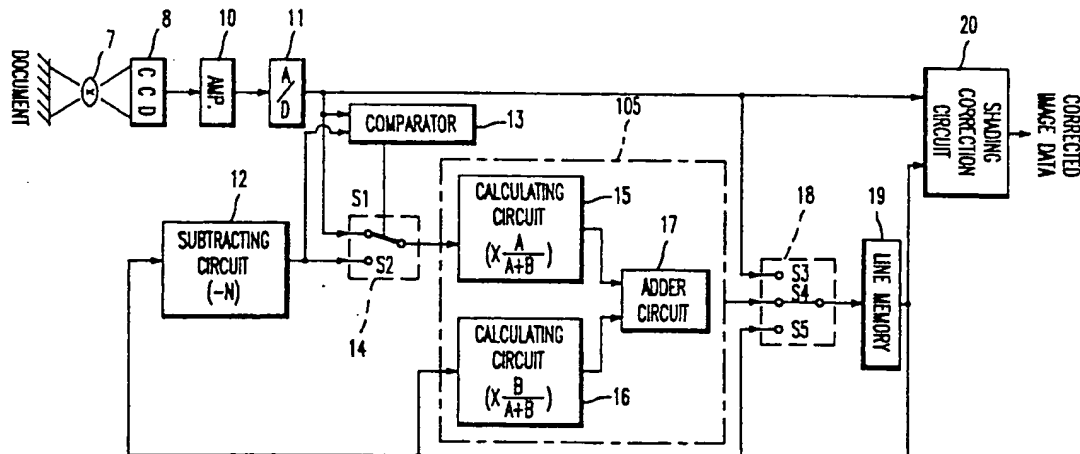
Assistant Examiner—Kim Yen Vu

Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt

[57] **ABSTRACT**

A white reference data generating unit which generates white reference data used in a shading correction process includes a line memory for storing white reference data, a determination circuit for determining whether or not the image data supplied from an image sensor is equal to or less than a predetermined threshold level, a updating circuit for updating the white reference data stored in the line memory to new white reference data calculated based on the white reference data stored in the line memory and input data while each line on a white reference plate is scanned, and a selector for supplying the image data, as the input data, to the updating circuit when the determination circuit determines that the image data is greater than the threshold level, and for supplying difference data, as the input data, to the updating circuit when the determination circuit determines that the image data is equal to or less than the threshold level, the difference data being obtained by subtracting a predetermined value from the white reference data stored in the line memory.

19 Claims, 4 Drawing Sheets





US005146351A

United States Patent [19]

Maehara

[11] Patent Number: **5,146,351**[45] Date of Patent: **Sep. 8, 1992**[54] **IMAGE READER**

[75] Inventor: Yoshiaki Maehara, Fukuoka, Japan

[73] Assignee: Matsushita Electric Industrial Co.,
Ltd., Kadoma, Japan

[21] Appl. No.: 750,736

[22] Filed: Aug. 21, 1991

Related U.S. Application Data

[63] Continuation of Ser. No. 593,326, Oct. 2, 1990, abandoned, which is a continuation of Ser. No. 396,079, Aug. 21, 1989, abandoned.

[30] **Foreign Application Priority Data**

Aug. 22, 1988 [JP] Japan 63-207650

[51] Int. Cl.⁵ H04N 1/40

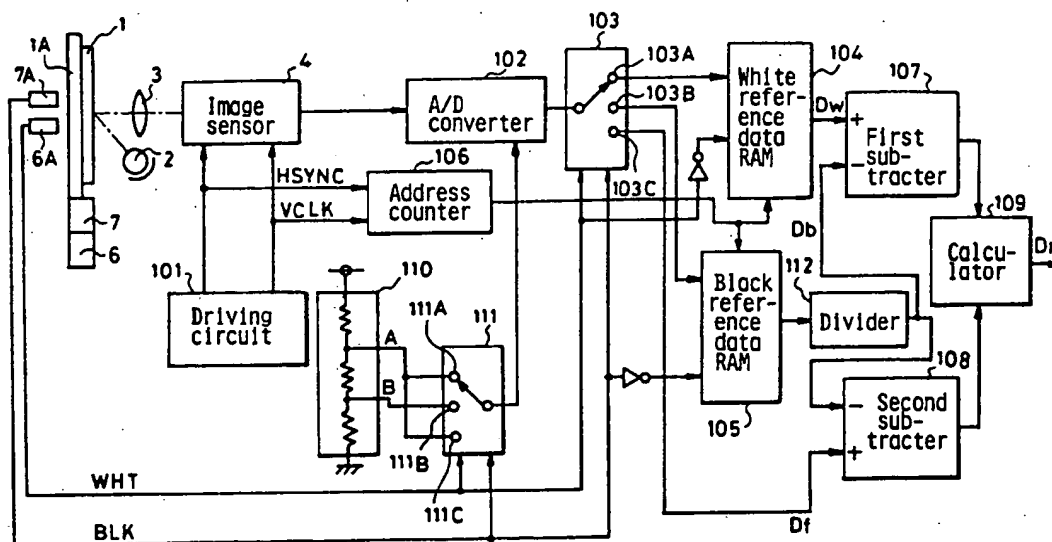
[52] U.S. Cl. 358/448; 358/461

[58] Field of Search 358/406, 446, 447, 452,
358/456, 462, 467, 471, 473, 474, 475, 483, 455,
458, 461, 463, 465, 448; 382/50, 53, 54[56] **References Cited****U.S. PATENT DOCUMENTS**

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4,660,082	4/1987	Tomohisa et al.	358/406
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Primary Examiner—Edward L. Coles, Sr.*Assistant Examiner*—Jerome Grant, II*Attorney, Agent, or Firm*—Cushman, Darby & Cushman[57] **ABSTRACT**

An image signals of a black reference plate, a white reference plate and a manuscript detected by an image sensor are converted into digital data by an A/D converter, and in the A/D conversion, the image signal of the black reference plate which is enhanced in level is applied to the A/D converter, and then the enhanced digital data for the black reference plate is returned to an original level, and a corrected image data which is represented by a difference of the image data of the manuscript and the image data of the black reference plate is issued.

4 Claims, 10 Drawing Sheets



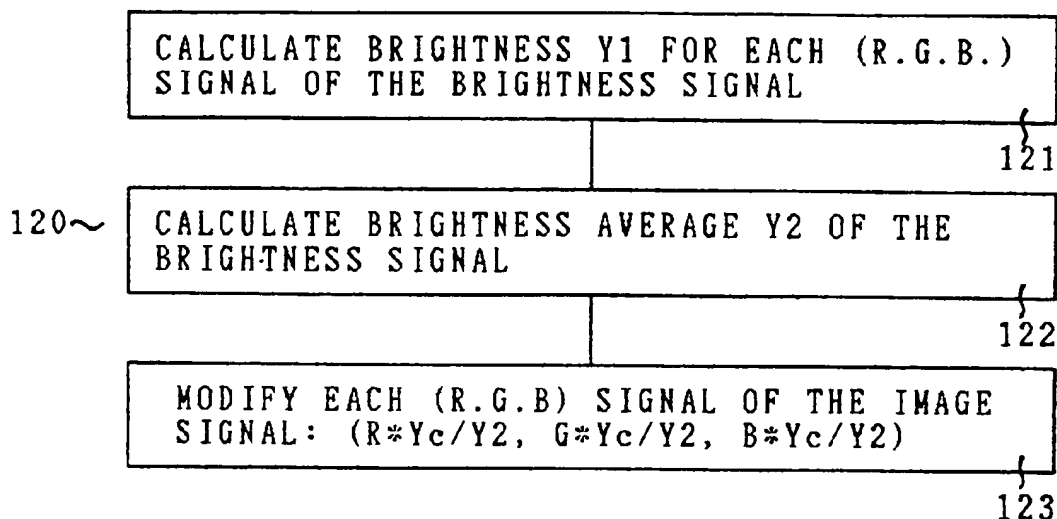
US006522432B1

(12) **United States Patent**
Lin(10) Patent No.: **US 6,522,432 B1**
(45) Date of Patent: **Feb. 18, 2003**(54) **IMAGE SCANNER WITH AUTOMATIC
SIGNAL COMPENSATION**(75) Inventor: **Chien-Chih Lin, Hsien (TW)**(73) Assignee: **Primax Electronics Ltd., Taipei (TW)**(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 1049 days.(21) Appl. No.: **08/633,389**(22) Filed: **Apr. 16, 1996**(51) Int. Cl.⁷ **H04N 1/04**(52) U.S. Cl. **358/475; 358/296**(58) Field of Search 358/296, 461,
358/463, 465, 475, 509, 512, 516, 484;
348/234, 500, 708(56) **References Cited****U.S. PATENT DOCUMENTS**5,151,796 A * 9/1992 Ito et al. 358/475
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Primary Examiner—Mark Wallerson(74) *Attorney, Agent, or Firm*—Winston Hsu(57) **ABSTRACT**

The present invention relates to an image scanner with automatic signal compensation function for compensating the instability of a light source of the image scanner. The image scanner comprises a test region, a light source for illuminating the document and the test region, optical means for conveying the light reflected from the document and the test region, a line image sensor for receiving the light from the optical means and generating an image signal corresponding to the light reflected from the document and a brightness signal corresponding to the light reflected from the test region, and a signal compensation circuit for amplifying the image signal according to the brightness signal to compensate the instability in the brightness of the light source.

9 Claims, 3 Drawing Sheets



US005726771A

United States Patent [19]

Gann et al.

[11] Patent Number: **5,726,771**[45] Date of Patent: **Mar. 10, 1998**

[54] **SYSTEM AND METHOD FOR OPTIMIZING TONAL RESOLUTION IN AN OPTICAL SCANNER**

[75] Inventors: **Robert G. Gann, Bellvue; Robert E. Sobol, Ft. Collins, both of Colo.**

[73] Assignee: **Hewlett-Packard Company, Palo Alto, Calif.**

[21] Appl. No.: **332,210**

[22] Filed: **Oct. 31, 1994**

[51] Int. Cl.⁶ **H04N 1/40**

[52] U.S. Cl. **358/445; 358/446; 382/270; 382/273**

[58] Field of Search **358/483, 482, 358/446, 445, 406, 447, 461, 463, 504, 475, 509, 512, 479, 520; 348/229, 255, 222, 300, 297; 382/273, 270**

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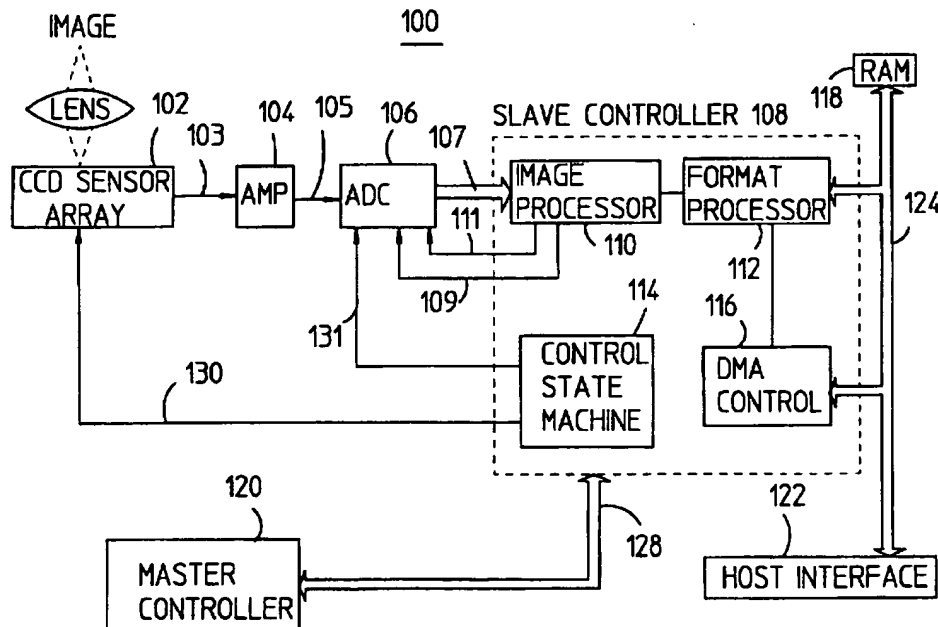
Primary Examiner—Edward L. Coles, Sr.

Assistant Examiner—Fan Lee

[57] **ABSTRACT**

The tonal resolution of an image scanner is improved by adjusting the dynamic range of an analog-to-digital converter of the scanner. A preview scan of the image is made. The image data from the preview scan is then analyzed to determine a maximum intensity and a minimum intensity. The value of the maximum intensity is used to set a white intercept of the image scanner such that a maximum digital value of the analog-to-digital converter corresponds to the maximum intensity present in the image data from the preview scan. The minimum intensity is used to set a black intercept of the image scanner such that the minimum intensity in the image data from the preview scan corresponds to the minimum digital number output by the analog-to-digital converter. Tonal resolution of the image scanner is optimized then by performing a final scan of the image with the analog-to-digital converter programmed to reflect the new white intercept and black intercept values.

15 Claims, 3 Drawing Sheets





US005249068A

United States Patent [19][11] **Patent Number:** 5,249,068**Takase**[45] **Date of Patent:** Sep. 28, 1993[54] **IMAGE READING APPARATUS**[75] **Inventor:** Osamu Takase, Yokohama, Japan[73] **Assignee:** Ricoh Company, Ltd., Tokyo, Japan[21] **Appl. No.:** 631,912[22] **Filed:** Dec. 21, 1990[30] **Foreign Application Priority Data**

Dec. 25, 1989 [JP] Japan 1-335277

[51] **Int. Cl.⁵** H04N 1/40[52] **U.S. Cl.** 358/461; 358/464;
358/471; 358/475[58] **Field of Search** 358/461, 464, 471, 445,
358/446, 463, 465, 496, 475[56] **References Cited****U.S. PATENT DOCUMENTS**

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Primary Examiner—Edward L. Coles, Sr.**Assistant Examiner**—Fan Lee**Attorney, Agent, or Firm**—Oblon, Spivak, McClelland,
Maier & Neustadt[57] **ABSTRACT**

An image reading apparatus having a line sensor for supplying an image signal in accordance with a brightness of a specified region of an original document along a main scan line, the line sensor having a plurality of photoelectric conversion elements aligned along a main scan line. The image reading apparatus comprises a sampling part for sampling and holding a level of a reference signal initially outputted by the line sensor when a reference board is scanned, a correction part for calculating a correction quantity according to a level of a signal outputted by the photoelectric conversion elements when the specified region of the original document is scanned, a subtraction part for subtracting the correction quantity from the level of the reference signal when the reference board is scanned, to supply a corrected reference signal according to the brightness of the specified region of the original document, and a normalization part for normalizing a level of an image signal outputted by the photoelectric conversion elements when the original document is scanned, based on a level of the corrected reference signal from the subtraction part.

9 Claims, 4 Drawing Sheets